

Conclusion

Findings from the analysis of the 1998 and 2004 hog surveys indicate important relationships between the scale of production and manure management practices and outcomes. Most importantly, large operations have altered their manure management decisions in response to binding nutrient application constraints. This finding is suggested by the positive association between scale of production and:

- (1) a greater likelihood of removing manure from the operation, especially by giving it away for free;
- (2) a lesser likelihood of applying both commercial fertilizer and manure to crops;
- (3) a greater likelihood of applying manure to crops with a high rate of nutrient uptake (e.g., Bermuda grass) and of adding microbial phytase to feed; and
- (4) a greater likelihood of testing manure for nutrients and of following a comprehensive nutrient management plan.

Manure management practices and outcomes have also changed significantly over time. Many of these changes can be attributed to the pronounced structural changes in hog production that occurred between 1998 and 2004—particularly farm size and regional shifts. For example, the relative growth of production in the Heartland compared to the Southeast likely explains much of the shift from lagoons to pit/tank systems, despite lagoons being more prevalent among larger operations. Other major changes between 1998 and 2004 include:

- (1) a decline in the spreading of solid manure and liquid manure without injection, among farms applying manure;
- (2) an increase in the average manure application intensity (animal units per acre) among farms applying manure;
- (3) a small decline in the manure application intensity among the largest operations;
- (4) a decline in the nutrients excreted per animal due to an increase in feed efficiency;
- (5) an increase in the share of farms removing manure from their operation;
- (6) an increase in manure nutrient testing rates; and
- (7) an increase in the use of microbial phytase in feed.

Environmental policies are also behind some of the observed patterns of change in hog manure management. The regional shift in production was partly a response to State regulations that sought to reduce negative environmental outcomes associated with large hog manure lagoons. The number of Federal and State policies designed to reduce the overapplication of manure

nutrients also grew between 1998 and 2004. In 2004, 30 percent of farms, representing 62 percent of animal units, followed a nutrient management plan. Nutrient application restrictions and the desire to avoid future liabilities and lawsuits could explain the increasing share of operations moving manure off the farm, testing manure for nutrients, and using microbial phytase in feed. While the manure-nutrient application intensity generally increases with farm size, the fact that the application intensity declined on the largest operations between 1998 and 2004 suggests that environmental policy is contributing to the adoption of conservation-compatible manure management practices.

The increasing concentration of hog production on large operations is expected to continue, meaning that manure management will continue to be an important issue to the hog industry and others concerned with its environmental impact. Results of this research imply that hog producers have responded to policy incentives, both positive and negative, designed to address the manure management issue. The findings also suggest that there still is significant room for reducing the environmental impact of manure disposal. For example, hog operations, on average, apply manure to less than 30 percent of available crop acreage. Policy incentives, along with technological innovation, are likely to play an important role in the future of hog manure management and its environmental impact.